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AN APPEAL

OF THE MERCHANTS OF NEW YORK CITY TO THEIR
ASSOCIATES AND CITIZENS OF THE STATE UPON
THE SUBJECT OF TRANSPORTATION.

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A DEED OF TRUST

EXECUTED BY THE "BUFFALO, SYRACUSE AND ALBANY
RAILROAD COMPANY" TO WM. A. COLE, FRANKLIN
EDSON, E. R. LIVERMORE, AND OTHERS.

AN ACT

TO BE PRESENTED TO THE LEGISLATURE OF 1879, TO
SECURE CHEAPER TRANSPORTATION TO THE
PEOPLE OF THE STATE OF NEW YORK.

The Future of the Erie Canal.

BY

JOHN B. JERVIS, C. E.

All communications to be addressed to

F. E. FROTHINGHAM,

Secretary,

At the Company's office, Coal and Iron Exchange Building,

CORTLANDT STREET,

New York City.

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AN APPEAL

OF THE MERCHANTS OF NEW YORK CITY TO THEIR ASSOCIATES AND CITIZENS OF THE STATE UPON THE SUBJECT OF TRANSPORTATION.

Believing that the prosperity of the people of the State, and particularly of the city of New York, is dependent on commerce and transportation, and that our natural commercial advantages are to a great extent nullified by the present monopolies in transportation, we, Trustees, engaged in active business, present these our views to the people in the hope that they will find active support from all who are interested in the well-being of our State. New York City has a great natural advantage in the possession of the finest harbor on the North American Continent, but it is not nearer the producers of most staples of trade and export than are other cities, and unless produce can be brought to this city from the West as cheaply as to Philadelphia, Baltimore, or Boston, commerce will leave us.

The Erie Canal, at the time of its construction and for many years afterwards, furnished New York with the cheapest transportation facilities then known, and the city, in consequence of the construction of the canal, rose with unparalleled rapidity to the position of the first city in the Union. In later years the canal has been compelled to compete with steam roads and these railroads have not afforded New York any special facilities. On the contrary, other cities have lately enjoyed advantages in price of transportation greater than New York could secure, and much trade has been, and is now, diverted thereby from this city.

The canal has not made much progress. Each boat is now dragged as slowly and as expensively along, with no better power than that of horse or mule, as it was when the canal was first built. During a great part of the year the canal is closed, and from being the best and cheapest means of transporting goods, it has become the slowest, most uncertain. Railroads carry their freight both quicker and sometimes cheaper, and to other cities quicker and cheaper than to New York.

The railroads, as might be expected, are conducted solely with a view to their own profit. They charge the highest freight they can get. At one time they compete almost ruinously with each

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other, then they combine and demand the highest rates. Where they possess a monopoly they are merciless. The small merchants pay a higher price for moving their goods than the larger houses. Nobody knows what he may have to pay to-morrow or next week, or, from the system of "drawbacks," what his neighbor pays now. We must have a cheap rate of charges to New York or we cannot prosper.

It is useless to complain of the railroads. As long as they are monopolies they will of course, according to the law of monopolies, charge as much as they can, and vary their charges whenever such variation serves their interests.

To prevent this we must deprive them of their monopoly, we must utilize the Erie Canal—that is, in place of the now ridiculous system of towage by horses and mules, we must substitute the steam-engine, which shall bring freight on the boats in summer and on wheels in winter. Experiments have proved that a canal-boat cannot profitably carry its own steam motive power, nor is the canal itself adapted to this means of propulsion. Experiments have also shown that a locomotive can tow a boat as well as it can move a train.

Distinguished civil engineers have examined this system, and declare it practicable and the best. What is needed is legislative authority to construct a road on each bank of the canal, with such severe restrictions that the charge for towage and for transport in winter shall be cheap and unvarying.

If its profits are large, a portion of them, after a fair return to the stockholders, should be used to repurchase the road for the State, in consideration of the free use of the State property on the canal-banks as a road-bed.

Signed,

WM. A. COLE,
L. J. N. STARK,
E. R. LIVERMORE,
FRANKLIN EDSON,
WM. R. FOSTER, JR.,

Executive Committee
Board of Trustees.

We, the undersigned, have examined the proposed act under which the Buffalo, Syracuse, and Albany Railroad Company propose to build such a railroad, and in which it agrees to tow all canal-boats which offer at less than half the present cost.

We have also examined the Deed of Trust under which that company agrees to devote all earnings above ten per cent to the repurchase of the stock, with the view of ultimately returning it to the State of New York.

We believe that the scheme is feasible and fair.

We believe that something of the kind is absolutely necessary, and we ask every merchant and every citizen who is interested in the welfare of the State to examine the proposed act, and the deed referred to, and if he then approves the plan proposed, give it an earnest support.

New York, 1878.

Signed,

H. B. CLAFLIN & CO.
AMMIDOWN, LANE & CO.
LEWIS BROS. & CO.
VAN VOLKENBURGH & LEAVITT.
KAYNE, SPRING & DALE.
FRANCIS BAKER.
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TYLER & FINCH.
R. HILLER'S SONS & CO.
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Peter McCartee, *Att'y.*
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THE CHAS. PARKER CO.
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Per Chas. X. Cordier.
WIEBUSCH & HILGER HARDWARE CO.,
Ernst Hilger, *Treas.*
NORWALK LOCK CO.,
B. F. Libby, *Prest.*
LAMSON & GOODNOW MFG. CO.,
B. B. Yale, *Atty.*
N. S. SIMPKINS, Jr.
32 Pine St.
THE CENTRAL MINING CO.
By Jno. Stanton, Jr., *Treas.*
A. FIELD & SONS.
THE ATLANTIC MINING CO.,
By Jno. Stanton, Jr., *Treas.*
H. W. CAMPBELL & CO.
COOK & BERNHEIMER.
CHAS. SCHLESINGER,
Per J. B.
P. W. ENGS & SONS.
OELRICHS & CO.
WM. R. FOSTER.
STEVENS & BENEDICT.
MILES & HOLMAN.
N. F. HOWE.
CHAS. HAIGHT & CO.
PHILLIPS & CO.
FOSTER, RICHARDSON & CO.
GEO. S. HART & CO.
JOYCE & BILLINGS.
HENRY C. HOWELL.
THE GRAIN WAREHOUSING CO.,
R. H. Laimbeer, *Treas.*
YOUNG & SCOTT.

A DEED OF TRUST

EXECUTED BY THE "BUFFALO, SYRACUSE, AND ALBANY RAILROAD COMPANY" TO WM. A. COLE, FRANKLIN EDSON, E. R. LIVERMORE, AND OTHERS.

PREAMBLE.

Whereas, the Buffalo, Syracuse, and Albany Railroad Company, a corporation organized under and by virtue of the laws of the State of New York, is about to apply to the Legislature of said State for authority to build a railroad on the banks of the Erie and other canals, between the cities of Albany and Buffalo, for the towage of boats by steam-power, and intends to lease or construct a railroad from the city of Albany to the harbor of New York, in such manner and with the intention that a cheap and continuous line of transportation at fixed rates shall be established between the said cities and along the route of the said railroad, and that the entire ownership and control of the said railroad shall ultimately be vested in the people of the State of New York :

Now, therefore, for the purpose of carrying out these intentions and securing these ends, it is hereby mutually agreed by and between the said Buffalo, Syracuse, and Albany Railroad Company, party of the first part, and William A. Cole, William R. Foster, Jr., E. R. Livermore, Franklin Edson, John P. Townsend, John D. Mairs, E. A. Kent, C. R. Hickox, William I. Phillips, George T. Hope, L. J. N. Stark, F. A. Jayne, and Benjamin C. Bogert, as trustees, party of the second part, as follows :

ARTICLE I.

The capital stock of the said Buffalo, Syracuse, and Albany Railroad Company shall be ten millions of dollars ($10,000,000), represented by one hundred thousand shares, at the par value of one hundred dollars each.

ARTICLE II.

The party of the first part agrees that each and every certificate of stock of the said Buffalo, Syracuse, and Albany Railroad Company which shall hereafter be issued shall contain a provision, printed on the face thereof, binding the holder, his legal representatives and assigns, to abide by all the provisions, agreements, and conditions of this instrument, and no certificate of stock shall be issued by the said railroad company except the person to whom the same shall be issued shall, in writing, for himself, his legal representatives and assigns, accept and agree to be bound by all the articles, conditions, and agreements contained in these presents.

And the party of the first part agrees that it wiil call in all certificates of stock which have heretofore been issued, and issue new certificates containing the above-described provision in the place thereof, and that all present stockholders, on receiving such new certificates, shall in writing agree as above provided in the case of future stockholders.

ARTICLE III.

The party of the first part hereby agrees that each and every bond which shall be issued by the said Buffalo, Syracuse, and Albany Railroad Company shall contain the same provision described in the case of certificates of stock in the preceding article hereof, printed on the face thereof, and no bond shall be issued except the person or persons to whom the same shall be issued shall in writing for himself, his legal representatives and assigns, agree as provided in the preceding section hereof.

ARTICLE IV.

The party of the first part hereby agrees that upon obtaining the authority set forth in the preamble to this instrument, it will without unnecessary delay issue and convey to the above-mentioned trustees and thir successors, to be held by them in trust as herein set forth, one million dollars ($1,000,000) of the stock of the said Buffalo, Syracuse, and Albany Railroad Company, being ten thousand (10,000) shares thereof, at the par value of one hundred dollars ($100) each.

ARTICLE V.

The party of the first part hereby agrees to convey to the said trustees or their successors in trust as aforesaid, one tenth of any addition or increase that may hereafter be made to the capital stock of the said Buffalo, Syracuse, and Albany Railroad Company beyond the amount specified in article first hereof. But no such addition or increase shall be made without the assent, in writing, of at least two thirds of said trustees be thereunto previously obtained.

ARTICLE VI.

The party of the first part hereby agrees that the said trustees may purchase any and every share of the capital stock of the said Buffalo, Syracuse, and Albany Railroad Company, and each and every stockholder shall sell and transfer to the said trustees, on their demand, the stock held or owned by him, or any part thereof, for the sum of one hundred and fifty dollars ($150) for each share thereof, or for such less price as may be agreed upon by and between such stockholder and the said trustees.

ARTICLE VII.

It is hereby agreed by the party of the first part that no dividend hereafter to be declared on the capital stock of said railroad shall exceed five per cent semi-annually on the par value of said capital stock, from the time the said capital stock is paid in, except to make up to said rate of five per cent semi-annually deficiencies on dividends undeclared or unpaid, or which were made at a lower rate.

ARTICLE VIII.

It is hereby agreed by the party of the first part that the bonds to be issued by the said railroad company shall not exceed the amount of six millions of dollars, and shall bear interest at a rate not exceeding six per cent, payable in gold or its equivalent, except with the assent, in writing, of at least two thirds of such trustees previously obtained.

It is further agreed by the party of the first part that each bond so issued shall on its face provide that the holder thereof, his legal representatives or assigns, shall sell and convey the same to the said trustees or their successors on demand, for the sum of one hundred and thirty dollars for each one hundred dollars represented in said bond.

ARTICLE IX.

It is agreed by the party of the first part that it will, upon obtaining the aforesaid legislative authority, as soon as it conveniently may, and without unnecessary delay, construct or lease a railroad from the said city of Albany to the city of New York, in such manner as to make a continuous line with the railroad hereinbefore described, and the expense or rental of such railroad to be so constructed or leased shall be subject to the approval of at least two thirds of said trustees to be in writing expressed previous to any expense being incurred therefor.

ARTICLE V.

It is hereby agreed by the party of the first part that one tenth of all the net income of such leased or constructed railroad shall be paid annually to said trustees for the purposes of their trust.

ARTICLE XI.

It is agreed by the party of the first part that no railroad shall be leased as above set forth unless the directors or managers of such railroad, and at least such number of the stockholders thereof as shall represent a majority of all the stocks thereof, and legally competent to bind the said railroad, shall, in writing, agree to sell and convey to the said trustees on demand the stock of such railroad on tender of no more than one hundred and twenty dollars ($120) for each share or proportion of such stock as shall at its par value represent one hundred dollars. Nor shall any railroad be so leased by the party of the first part unless the director, managers, or persons controlling the same shall in some legal manner assure to the said trustees the right legally to demand and have conveyed and assigned to them the bonds of such railroad, if any there be, at a price of not more than one hundred and twenty dollars for each one hundred dollars represented at the par value thereof.

ARTICLE XII.

It is hereby agreed by the party of the first part, that any and all surplus earnings or profits over and above the necessary running expenses, repairs, interest and the dividends as herein set forth, shall be paid annually to the said trustees, or their successors, for the purposes of their trust.

ARTICLE XIII.

The parties hereto hereby agree that the said trustees, or their successors, or any part of committee thereof, shall, with the assent, in writing, of two thirds of their number, represent the stock and bonds held by them in trust under this instrument, at all meetings of the said Buffalo, Syracuse, and Albany Railroad Company, or other corporation whose property shall be leased by the party of the first part, and may exercise all the rights and privileges of individual holders thereof ; but no one of said trustees shall be eligible to the office of director in the corporation, party of the first part, until such time as the said trustees shall hold, in trust, under this instrument, three quarters in amount of the capital stock of said corporation, party of the first part, nor shall any of the said trustees be eligible to the office of director in any railroad which the party of the first part shall lease, until said trustees hold, in trust, under this instrument, three quarters of the capital stock of said leased railroad.

ARTICLE XIV.

It is hereby agreed that the said trustees may, at any time, convey and transfer by the proper instrument, and in legal manner, all their right, title, interest to the stock and bonds herein described as such trustees, to either the New York Produce Exchange, the Chamber of Commerce of the State of New York, or to the people of the State of New York, as they may deem expedient, and as may be provided for by necessary legislation ; provided the said New York Produce Exchange, or the said Chamber of Commerce of the State of New York, shall, on accepting such transfer, legally agree to carry out all the provisions of this instrument. And whenever the said trustees shall acquire, in pursuance of their said trust, all the capital stock and bonds of the said Buffalo, Syracuse, and Albany Railroad Company, and of the railroad or railroads which may be constructed or leased by said company, it shall become the duty of said trustees to make all proper and lawful endeavors to procure such legislation, that they the said trustees may thereby terminate their said trust.

ARTICLE XV.

It shall further be the duty of said trustees, whenever they shall so acquire all the capital stock and bonds above described, to so arrange the fares and charges of the said railroads that the same shall suffice merely to pay the necessary repairs and running expenses of the said railroads and canals.

ARTICLE XVI.

It is agreed that the said trustees may use such portion of the trust funds and property as come into their hands as may be necessary for the expenses connected with their trust.

ARTICLE XVII.

The said trustees may fill all vacancies that may occur in their number from any cause, and may make any lawful rules they deem expedient for their guidance.

ARTICLE XVIII.

The party of the first part agrees to furnish a free pass to each of said trustees over the roads controlled by said party of the first part.

ARTICLE XIX.

It is hereby agreed that a vote of two thirds of all said trustees or their successors, recorded in writing, shall be necessary in all matters directly connected with the business or affairs of the party of the first part.

ARTICLE XX.

The parties of the second part hereby agree for themselves and their successors to accept the trust as herein set forth, and to administer the same according to the terms and conditions herein expressed.

ARTICLE XXI.

The said trustees, parties of the second part, agree to receive, and their treasurer shall receipt for, all stock, bonds, and moneys received by them, and shall annually report a detailed account of all their receipts and expenses to the Board of Directors of the Buffalo, Syracuse, and Albany Railroad Company.

ARTICLE XXII.

The parties of the second part agree to invest all moneys coming into their hands under this trust in the manner herein described, and first to invest the same in the capital stock of said Buffalo, Syracuse, and Albany Railroad Company until they shall hold every share thereof ; then, secondly, to invest such moneys as they shall receive in the bonds of said railroad, and afterwards in the capital stock and bonds of such roads as may be constructed or leased by said party of the first part. Whenever the said trustees shall have a sufficient and proper amount for investment in their hands, they shall give public notice, by advertisement, inserted daily, for at least fifteen days, in at least two daily newspapers published in the city of New York, of their intention so to invest, specifying the amount and inviting proposals, the lowest of which shall be accepted, provided the same shall be below the sums hereinbefore specified. In case adequate proposals are not received, the trustees shall demand and purchase stock or bonds as hereinbefore set forth.

Signed and sealed this thirteenth day of April, in the year one thousand eight hundred and seventy-eight.

BUFFALO, SYRACUSE, AND ALBANY RAILROAD COMPANY, by

(Signed) J. D. FEATHERSTONHAUGH,
President. [SEAL.]
(Signed) F. E. FROTHINGHAM,
Secretary.

CITY AND COUNTY OF NEW YORK, *ss.:*

On this fifteenth day of April, in the year one thousand eight hundred and seventy-eight, before me personally came Francis E. Frothingham, Secretary of the Buffalo, Syracuse, and Albany Railroad Company, with whom I am personally acquainted, who, being by me duly sworn, said that he was the Secretary of the said Company, that he knew the corporate seal of said Company, that the seal affixed to the above instrument was the corporate seal of the said Company, that it was so affixed by order of the Board of Directors of the said Company, and that he signed his name thereto by the like order as such Secretary; and said Francis E. Frothingham further said that he was acquainted with James D. Featherstonhaugh, and knew him to be the President of said Company; that the signature of said James D. Featherstonhaugh was subscribed hereto by like order of the said Board of Directors in the genuine handwriting of said James D. Featherstonhaugh, and in the presence of the said Francis E. Frothingham.

(Signed) GEORGE B. ASHLEY, [SEAL.]
Notary Public N. Y. Co.

(Signed)

WM. A. COLE, [SEAL.]
WM. R. FOSTER, JR., [SEAL.]
E. R. LIVERMORE, [SEAL.]
FRANKLIN EDSON, [SEAL.]
JNO. P. TOWNSEND, [SEAL.]
JOHN D. MAIRS, [SEAL.]
E. A. KENT, [SEAL.]
C. R. HICKOX, [SEAL.]
WM. I. PHILLIPS, [SEAL.]
GEO. T. HOPE, [SEAL.]
L. J. N. STARK, [SEAL.]
F. A. JAYNE, [SEAL.]
B. C. BOGERT, [SEAL.]

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK, } *ss.* :

On the sixteenth day of April, eighteen hundred and seventy-eight, personally appeared before me William A. Cole, William R. Foster, Jr., and E. R. Livermore ; and on the twenty-second day of April, eighteen hundred and seventy-eight, personally appeared before me George T. Hope ; and on the twenty-third day of April, eighteen hundred and seventy-eight, personally appeared before me L. J. N. Stark, F. A. Jayne, and B. C. Bogert, all of whom are to me personally known, and known to me to be the individuals described in and who executed the foregoing instrument, and they severally acknowledged that they executed the same for the purposes therein mentioned.

(Signed) GEORGE B. ASHLEY, [SEAL.]
Notary Public, N. Y. Co.

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK, } *ss.* :

On the seventeenth day of April, eighteen hundred and seventy-eight, personally appeared before me a duly appointed notary public in and for the city and county of New York, Franklin Edson, John P. Townsend, John D. Mairs, and E. A. Kent, to me known, and known to me to be the individuals who executed the above instrument, and who severally acknowledged that they executed the same for the purpose therein stated.

(Signed) S. H. GRANT, [SEAL.]
Notary Public, City and County of New York.

STATE OF NEW YORK,
CITY AND COUNTY OF NEW YORK, } *ss.* :

On the twenty-second 22d day of April, one thousand eight hundred and seventy-eight, personally appeared before me a duly appointed notary public in and for the city and county of New York, C. R. Hickox and William J. Phillips, to me known, and known to me to be the individuals who executed the above instrument, and who severally acknowledged that they executed the same for the purposes therein stated.

(Signed) S. H. GRANT, [SEAL.]
Notary Public, City and County of New York.

AN ACT

TO BE PRESENTED TO THE LEGISLATURE OF 1879, TO SECURE CHEAPER TRANSPORTATION TO THE PEOPLE OF THE STATE OF NEW YORK.

STATE OF NEW YORK.

An Act to secure cheaper transportation to the people of the State of New York by the use of locomotives on the banks of the canals of the State, and authorizing the Buffalo, Syracuse, and Albany Railroad Company to construct a railroad thereon, and use the same for towing and transportation purposes.

The People of the State of New York, represented in Senate and Assembly, do enact as follows :

SECTION 1. For the purpose of reducing the expense of canal transportation, the Buffalo, Syracuse, and Albany Railroad Company, its successors or assigns, are hereby authorized and empowered to introduce upon the canals owned by the State a system of towage by locomotives upon tracks to be laid by said Company upon each bank of such canals ; and the said Buffalo, Syracuse, and Albany Railroad Company are hereby authorized and empowered to lay such tracks as may be necessary for such purpose with the necessary turnouts, buildings, and other appurtenances, and to run locomotives and cars over the same, provided that the laying of such rails and the construction and operation of such railroad shall not interrupt or prevent the use of the said canals in the manner they are now and heretofore have been used. In constructing such railroad, and in connecting the tracks across the canals, the work shall be done in such manner as shall be approved by the State Engineer or the Superintendent of Public Works.

§ 2. The Buffalo, Syracuse, and Albany Railroad Company, its successors or assigns, shall tow for hire, by their locomotives or by animal power, each boat, float, and raft that may be offered loaded or empty, at ten cents per mile, for any (greater or less) distance.

§ 3. In order to prevent any discrimination in prices to be charged by the said Railroad Company, in the transportation of persons or property on the railroad to be constructed by the said Company, it is hereby provided that they shall not charge a higher rate than three quarters of a cent per ton per mile for through freight moved on their tracks, and no more than one and one half cents per ton per mile and twenty cents a ton for loading or unloading local freights in all cases in quantities not less than a car-load, and in less amounts such uniform rates as the Railroad Company may establish, and rates not exceeding one and a half cents per mile upon passengers, through or local.

§ 4. The system of towage hereby authorized shall be subject to the supervision and control of the Canal Board, and the same shall be subject to all the rules and regulations established or to be established by the Canal Board for the navigation of canals.

§ 5. The said Buffalo, Syracuse, and Albany Railroad Company shall, not later than sixty days after the passage of this act, execute a deed or other proper and legal instrument of trust creating a Board of Trustees, consisting of not less than thirteen persons, citizens of the United States and residents of the State of New York, and shall convey to the said trustees, to be held by them as a sinking fund, one tenth part of all the stock which has been or shall hereafter be issued by the said Company ; and the said trustees shall receive all dividends which shall be declared on the said stock, and interest which shall accrue on the bonds hereinafter mentioned, and shall use such interest and dividends to purchase other stock or bonds of the said Company at a price not exceeding one hundred and fifty dollars on each one hundred dollars of said stock at its par value, and one hundred and thirty dollars on each one hundred dollars of the bonds of the said Buffalo, Syracuse, and Albany Railroad Company, at their par value, and one hundred and twenty dollars on each one hundred dollars of the capital stock or bonds of any railroad which may be leased by the said Buffalo, Syracuse, and Albany Railroad Company, at their par value ; and no stock or bonds shall be issued by the said Company, except the same be subject to the above conditions, and the persons to whom the same shall be issued shall, in writing, express their assent thereto and agree to sell the same to said trustees on demand, at the above-mentioned prices. That no increase of stock or bonds beyond that mentioned in the said deed of trust shall be issued without the express written assent of at least two thirds of said trustees. That the said trustees shall purchase and accumulate the said stock and bonds until such time as they shall hold all of the same, whereupon they shall convey the same to the people of the State of New York, or to such other trustees as the Legislature shall for that purpose designate. That said deed or instrument of trust shall also stipulate that no dividend shall be declared on the said capital stock exceeding five per cent semi-annually, and any net earnings exceeding that rate shall be paid over to said trustees for the purpose of their trust. That the said Company shall not lay rails or commence any structure or work on the property of the State until the said deed or instrument of trust shall be duly executed; and if the same be not executed before the expiration of sixty days after the passage of this act, then all privileges and rights herein granted to the said Company shall be inoperative and cease.

§ 6. In case the said Railroad Company, its successors or assigns, shall neglect or fail to introduce said system of towing on the Erie and Oswego canals, between the Hudson River and the lakes, within two years after the passage of this act, all rights and privileges herein granted shall cease, and said Company shall remove all structures erected by them on the banks of the canals, and replace the banks, as found, if required to do so by the Canal Board.

§ 7. This act shall take effect immediately.

FUTURE OF THE ERIE CANAL.

BY JOHN B. JERVIS, C.E.

THE career of the writer as an engineer commenced with the original construction of the Erie Canal, and was continued in this service seven years. About the year 1833, the traffic on the canal had become large, and, with a view to economize transportation and increase its capacity, measures for its enlargement were proposed. I took an active part in the discussion of the subject. From the time I first engaged on the canal, in 1818 (just sixty years ago), to the present time, I have noticed with great interest the important bearing of this great work on the commercial prosperity of the State, and especially its influence in giving eminence to the commercial character of the City of New York. With this experience and these views of the importance of this improvement, it has been painful for me to notice the predictions made of late, that the canal was losing its power as the chief means of transport. Sundry measures for applying steam-power have been at times proposed, and I hoped some one of these would be successful. Then it came to be considered by some that all tolls must cease in order to meet competition. This last measure I did not believe the State would adopt. To my judgment, it appeared necessary to look for some method of economizing transportation that would at least pay all current expenses.

Early in January I was called upon by several gentlemen, to consider a plan which they presented, for using steam as the power for towing boats on the canal. They presented me with a project of a law for carrying out the plan. I thought favorably of the plan of towing, but not of the law.[1] It did not appear to me to be necessary for such a purpose, that the question of canal tolls should be coupled with a system of towing. But I supposed this would be modified by the Legislature. I had no doubt boats could be successfully towed by a locomotive, and at the request of those gentlemen, I agreed (if my health should permit) to visit Albany, and explain the plan to a committee of the Legislature, in addition to others.

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[1] Since this article was written, the objectionable feature has been removed from the bill.

Accordingly I went to Albany the latter part of February last, and gave my views, so far as they were called for, to the committee.

While at Albany I heard much discussion, pro and con, on this subject, and it appeared to me that it was not well understood. I was about three days in Albany. In view of what I had noticed and heard, I was led to believe the subject needed a more full and careful investigation of its characteristics. To me it appears a matter of public importance, and though I am so far advanced in life, I could hardly be expected to take such labor, I concluded to undertake it, and the following paper is the result of my investigations. I the more cheerfully submit it to the public, for the reason I can have no interest other than that of any citizen who is interested in the prosperity of the State. I can have no interest as looking to professional employment, as I could not be induced to take any, except as I might regard some service I might render as a public duty.

In the following paper I have shown a canal-boat may be towed by a locomotive at a less rate per mile on the Erie Canal than is now charged per mile on the Hudson River.

If any better plan can be presented, I shall be happy to see it adopted. We want the best that can be devised. I am sure it must be by the use of steam-power for towing. If this is not in some way successfully adopted, we may expect the canal to ultimately fail, and leave us no alternative but a railway on its site, so restricted as to give the best facilities it can afford in sustaining the commercial interests of the State and City. I do not believe this is necessary, but that the canal, by the use of steam towing and a reasonable business economy in its repairs, will maintain its superiority over railways in the transport of freight, and continue, as it has been, the great channel of transportation between the lakes and tide-water. With these views, I submit the following paper to the intelligent and candid consideration of the public. If I am not right, I do not wish to be approved. Some plan must be adopted, and, so far as I can judge, the one I propose is the best the present state of engineering suggests. No one can fail to see the importance of putting the canal in a condition by which it will sustain itself against all rivals.

It has been stated that the Erie Canal, which was once a controlling power in the commerce of New York State, is now in the condition of "decadence." A rival of superior power has appeared in the railroad, and the canal is no longer able to maintain its ascendency. The instrument that has been so potent in giving New York City its commercial importance is passing away.

The great rival to the canal began to be considered as a means of general transportation about fifty years ago. At first it was considered necessary to transmit the power of a locomotive engine to a train of cars by means of a rack and pinion or cog-wheels. This method was actually put in operation and worked several years in England. Other methods were devised, all of which failed to make the locomotive a fit power for general traffic. About 1820 it was suggested the power of the locomotive could be applied through the adhesion of the wheels to the rail ; on this principle the Stockton and Darlington Railway was opened for traffic—mostly coal. In the first edition of his treatise on railways, Mr. Wood gave experiments made by himself and others as to the efficiency and extent this medium of transmission could be depended on. Considering the average state of the rails, Mr. Wood gave it as his opinion that $\frac{}{25}$ of the weight on the driving-wheels was all it was safe to assume, in providing power to meet all conditions of the rails. In 1827, the experiments with locomotives on the Liverpool and Manchester Railway showed this medium was greater than Mr. Wood had supposed. In my report to the Delaware aud Hudson Canal Company, in 1827. on the Carbondale Railway, I ventured to assume this ratio as 1 in 17 ($\frac{1}{17}$) as a basis of tractile power. In 1848, in my report on the Hudson River Railroad, I stated it as 1 to 8 ($\frac{1}{8}$) as the result of experience up to that time. At the present time, it is generally considered as equal $\frac{1}{6}$ of the insistant weight on the driving-wheels. It is seen this established feature has not been suddenly invented ; it has been discovered in the progress of railway experience, developed by the operations of railways, and has come to its present maturity by slow degrees. To the appropriate limit of the weight on the driving-wheels, this medium of transmitting the tractile power of the locomotive to haul a train of cars on a railway is the most economical and full consumption of power known in the history of steam as a moving power. It is well known there is no difficulty in constructing a locomotive to work fully up to the adhesion of its driving-wheels.

I fully concur with Mr. John G. Stevens in what he says in a recent article[1] of the improvements that have been made in the rail track and machinery, but I consider these have mostly grown out of the development of the essential fact of the adhesion of the locomotive wheels to the rail. It is this fact that has opened up and established the economy of railway transport. It is not material what kind of body or vehicle is to be moved ; the efficiency of the tractile force is the same, it being provided the locomotive has a rail on which it can move. The use I propose to make of this principle of adhesion will appear on a later page.

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[1] *Scribner's Magazine*, November, 1877.

Mr. Stevens gives specimens or statistics of the cost of transportation on railways and on canals. On page 121 of *Scribner's* (November number) Mr. Stevens says : "In 1875, on the trunk lines, the rate averaged about eight mills, and in 1876 only six, the Pennsylvania road reporting under six, and the Philadelphia and Erie at five, the New York Central being stated at seven, and the Lake Shore at five and a half. . . . It will be remembered, moreover, that the above applies to the whole tonnage, both through and local, and that the former cost less to move than the latter. . . . It is the opinion of the managers of the New York Central and the Pennsylvania railroads, that the net cost of through freight will not exceed four (4) mills. For the purposes of comparison with the expense by canal, it will be safer, however, to make no deduction on this account, but take the rate of six mills as the cost of through tonnage. In the computation of canal expense, as given below, the interest on the boats is included. It is therefore proper, in making a statement of comparative cost of the two modes, to make an allowance for the interest on railroad equipments ; a rate of half a mill will cover this, thus making the total railroad expense six and a half mills." This six and a half mills per ton per mile makes no provision for capital invested, except for the running machinery. After discussing incidental advantages by rail, Mr. Stevens proceeds to examine the cost of canal freights, and states the rates in years long gone by, and then comes down to the period from 1870 to 1876. He says : "From this experience the rule under present conditions would be five and a half mills. . . . If the prices of labor and materials should continue to fall, the rate might possibly be placed at five and a quarter mills. This is, however, a minimum, and it is doubtful if it could attract the capital necessary for the construction of new boats." Of course if freights do not pay, the navigation will be abandoned. Mr. Stevens goes on to ascertain how much must be added to current expenses of the boatmen to pay for the maintenance of canal repairs. For this he adds one and a half mills to canal freights, making the total of "six and three quarter mills by canal, as compared with six and a half by rail." In this, I suppose, Mr. Stevens, though he does not state it, includes repairs of railroads in current expenses. We have, then, canal freights at six and three quarter mills, and railroad freights at six and a half mills, as including all expenses except interest on capital invested in the railroad and canal, other than the boats and machinery.[1]

It will be noticed the State Engineer, in the statement below, includes both canal and river expenses. In order to compare with

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[1] The State Engineer (John D. Van Buren), in his report for 1877, gives a detailed statement of the cost of canal freights. In this report (1877, at page 42) he presents the following statement on boats towed by animal power :

"Estimate of the cost of transporting wheat from Buffalo to New York on Erie Canal, with animal power ; season, 210 days ; number of trips per year, seven, or thirty days per trip.

Investment.

Cost of boat to carry 230 tons of cargo	$4,000 00
" horses, 4 @ $125	500 00
" harness, 4 sets @ $15	60 00
Total investment	$4,560 00

Annual Expenses.

Interest on investment @ 7 per cent	$319 20	
Reserved fund to replace boat in 10 years	289 60	
Repairs of boat, 8 per cent of cost	320 00	
Insurance on boat	20 00	
		$948 80

Crew, including Board.

1 captain	$90 00	
1 steersman	20 00	
2 drivers, @ $12	24 00	
1 cook	10 00	
	$144 00 × 7 trips	$1,008 00

Keep of horses, including shoeing, 4 × 25 × 7 months, " " " " 4 × 10 × 5 "	$900 00	
Reserved fund to replace horses in 6 years	69 90	
		969 90
River and harbor towage, 60 × 7 trips		420 00
Commissions, 25 × 7 trips		175 00
Insurance on cargo, 35 × 7 trips		245 00
Wharfage and incidentals, 7 × 7 trips		49 00
		$3,815 70

Tons transported eastward, 230 × 7 = 1,610.00 " " westward, 57.5 × 7 = 402.50	2,012.50
Cost per ton moved from Buffalo to New York, 495 miles	$1,896 00
Cost per ton per mile from Buffalo to New York	3.83 mills."

canal, it will be necessary to inquire how much is chargeable to river expenses.

The State Engineer (Van Buren) remarks, that he considers the above estimate as a maximum of economy, and rather more than can be relied upon as a basis of average economy. It is therefore evident it must be taken with some allowance. The statement includes the use of boats and expenses of crew from the time they enter the river until their return to the canal. What this time exactly is, I do not see stated ; though the whole time for a round trip on both canal and river is stated at 30 days. The time of passage from Buffalo to Troy is given at 10$\frac{1}{12}$ days, and the return passage at two miles per hour equals 7$\frac{1}{6}$ days, which together is, say, 17½ days. If 3 days be allowed as time required in harbor at Buffalo (which is probably sufficient), we have 9$\frac{1}{6}$ days left for the boat on the river.[1]

It is proper to mention the State Engineer regards his estimate as the minimum cost of freight, and that the average would be something more. As he takes a basis from the examination of the

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[1] The rent of boat and expense of crew (deduced from State Engineer's report) is

$8.42 per day × 9½ days		$79 99

Certain terminal expenses should be charged according to mileage on canal and river portion of the route, of which—

Commissions on cargo	$25 00		
Insurance on cargo	35 00		
Wharfage and incidentals	7 00		
For a total distance of 495 miles		$67 00	
As 495 is to 67, so is 150 to	$20 30		
To which add river and harbor towage	60 00		80 30
Total for deduction			$160 29
Total cost by State Engineer's estimate			$3,815 70

$3,815.70 ÷ 7 = $545.10 per trip.
$545.10, less river portion, $160.29 = $384.81.
Remains for canal portion, say, $384.81.

Tons carried in round trips, per State Engineer, 287.50—230 tons east and 57.50 west. It is not supposed the west-bound was for the whole distance. I have no means of being exact on this point. As the shorter of the west-bound freights are now wholly carried by rail, I estimate this west-bound freight at 75 per cent of distance. 57.5 × .75 is 43.13, and this will make tons east and west aggregate 273.12 tons. Now 384.81 × 273.12 = $1.40 per ton carried.

Cost per ton per mile, $1.40 ÷ 345	4.05 mills
Add Mr. Stevens for maintenance of canal (which I do not admit, as I shall notice hereafter) at 1½ mills	1.50 "
Cost per ton per mile, including repairs of canal	5.55 "

arrival at Troy from Buffalo of seventy-two (72) consecutive loaded boats, there does not seem ground for any material errors ; but not to overstate the question, I add 10 per cent to his estimate—then we have $5.55 + \frac{1}{10} = 6.10$ mills per ton per mile as the cost of canal freight, including repairs of canal. This is about .65 mills below the estimate of Mr. Stevens for canal freights. As he states it, the cost by rail is 6.50 mills, and by canal 6.75 mills. I show above, by canal, 6.10 mills.

The comparison shows that the approximation is very close, and neither method can afford to neglect the most careful application of its means of economy. Both cases illustrate the great progress made in the means of transportation.

There was a time when it was said a horse would draw one ton on a good turnpike road, ten tons on a railway, and thirty tons on a canal. Now this rule is greatly changed to the benefit of railways. How is this ? It has come about by the discovery of means to apply steam-power to the railways, while the canal has been left dependent on horses. Take away the steam, and substitute horse-power on the railway, and the canal would still maintain its eminence. Mr. Stevens does not admit the practicability of using steam on the canal, unless it can be adapted to vessels of about 800 tons. I shall endeavor to show that steam can be used with economy in towing canal-boats, and that its application will be on the same principle as is adopted to tow a train of cars.

A locomotive steam-engine on a rail is well known to have large tractile power that can be appropriated to haul a train of cars. If this tractile power is applied to a boat in a canal, it will be exerted with essentially the same efficiency as though it were attached to a train of cars on the railway. The only drawback in the case of the canal is the loss by the slight angle of the towing medium, or tow-line, that is required from the necessity of laying the track for the locomotive on the bank of the canal. This loss is said to be about four per cent, and is the same for an engine as for a horse on the towing-path.

There is an impression in the minds of some men that there is some peculiar difficulty in applying the power of a locomotive steam-engine to the towing of a canal-boat.

When the Liverpool and Manchester Railway Company applied for a charter, there was great doubt and skepticism as to the possibility of so using the medium of the adhesion of the wheels as to effect the economical transportation of freight. These doubts are now wholly removed. Those who now doubt the possibility of applying the same tractile power to tow a boat, will as surely have their doubts removed when the plan is put in operation. The main cause of these doubts arises from the fact that the boat must move at comparatively slow speed. But this in no way affects the well-known power of the locomotive to exert its traction on any body that is to be moved, whether a boat in the water or a train of cars on a railway. Boats are moved through water by the tractile power of the steam-tug, worked by a screw, which is a far less effective application in tractile force than by the locomotive through the adhesion of its driving-wheels to the rail.

The only peculiarity is, the locomotive must be adapted to a lower rate of speed. The driving-wheels, instead of being four or five feet diameter, as used on the railway, will be for a boat little more than half this size. It is quite practicable that such a locomotive will work off its power in towing a fleet of boats with as much economy as it can be worked on a rail. On the rail it will move at higher speed—perhaps four times as great ; but the fleet of boats will carry four or five times the tonnage. No man familiar with mechanical power can fail to see that the locomotive exerts its tractile power just as efficiently in towing a fleet of boats as in towing a train of cars. The only difference is, in the case of the fleet it must be adapted to a slower motion than is expedient on the railway train.

POWER REQUIRED FOR TRACTION.

The first point is to ascertain the resistance of a boat moving at a certain velocity, or the tractile power required. To determine this question, the State Engineer (Van Buren) had a series of experiments made on canal-boats moved at different velocities. The results are given at page 58 in his recent report. I regard it as very creditable that the State Engineer has given so full an examination to determine the resistance of boats moving on the canal.

In his table opposite page 58, the tractile power to move a loaded boat 2.45 miles per hour, and allowing for current 2.68 miles per hour, required a traction of 543 lbs. It may therefore be taken, this experiment shows, that for a boat making 2½ miles per hour, 543 lbs. is the traction required.

It is proper to remark, the table referred to does not conform to the theoretic power due to speed ; for, in a case of a similar boat at 1.79 miles per hour, the power of traction was 316 lbs. The latter being a slower speed, is more likely to be correct. The case is—as 1.79^2 is to 316, so is 2.50^2 to 617 lbs., the traction that should have been indicated. It is, therefore, prudent to take the last as basis for traction.

By the same table, it appears that boats towed by a steam-tug have a greater resistance at same velocity, than was found when towed by horses. This the State Engineer accounts for as arising from the counter-current caused by the steamer—this counter-current meeting the boat, and thereby increasing the resistance. As no floating tug is to be used in the case of towing by a locomotive on the rail, there is no necessity of considering this aspect of the experiment.

EXPERIMENTS IN FLEETS.

At page 53, same report, the State Engineer says: "The boats being fastened in pairs close together, one ahead of the other, the total resistance is much less than for two single or separate boats; and besides the number of the crew can be very much reduced below what is required for two such boats." . . . "It is evident that most of the advantages of an enlarged boat are secured by coupling two ordinary boats in this manner; both boats can be steered by one wheel, and can pass sharp curves with the same ease as single boats." The economy of towing a fleet in line is further demonstrated by same table of experiments by State Engineer, as may be seen in his remarks on page 58, as to the results of tractile economy of two coupled boats as compared with single. He finds 2700 lbs. by single boats and 1900 lbs. by coupled boats, or the coupled boats are 70 per cent of the single. This reduced, will make the power for the boat in fleet $617 \times .70 = 432$ lbs.

It is therefore abundantly evident that a large gain in the economy of traction is obtained by towing in a fleet. But as I wish to be quite on the safe side, I shall take this at an average between the traction of single and a fleet, which is 525 lbs. To assume five boats in the fleet will require a tractile power of $525 \times 5 = 2625$ lbs.

POWER REQUIRED IN LOCOMOTIVE.

It has been stated that one sixth of the weight on driving-wheels may be relied on for the tractile power of a locomotive engine on a rail. If this be taken at 20,000 lbs. (a moderate locomotive), it gives 3333 lbs. tractile power. Deduct for angle of tow-lines 4 per cent, and we have 3200 lbs. as effective power for towing boats, or a surplus of 575 lbs.—sufficient for an additional boat, or for a fleet of six boats. That such an engine will tow five loaded boats 2½ miles per hour, can not be doubted by any man familiar with this class of power.

A RAILWAY NECESSARY.

In order to apply the locomotive most efficiently to the towing of boats on the canal, it is necessary to have a railroad on each bank. It is not sufficient to lay a rail on one bank, as this would not allow convenient passage of fleets past each other, when moving in opposite directions. I will not take the space necessary to explain this, as I think it will be obvious. A track must be laid on each bank. The distance for this, from Buffalo to the lower Mohawk aqueduct, is 340 miles. The remaining distance to tide water at Troy (five miles) has too many locks to allow economy in towing in fleet, and animal power must be used.

A railway on each bank of course will require 340 × 2 = 680 miles of rail. Add to this for side tracks, 100 miles. Total, 780 miles of rail track.

ESTIMATE FOR RAIL.

Gauge of track, 3 to 3½ feet. For this object a 50-lb. iron rail of good quality would be sufficient for this purpose. To prepare the rail bed, the canal banks must all be brought to their full height.

The bed may be prepared and track laid down on the 780 miles for about	$5,000,000
100 locomotives of the class required	600,000
Shop accommodations	500,000
Telegraph line	70,000
Drawbridges at towns	100,000
	$6,270,000
Add for contingencies and superintendence, 20 per cent	1,254,000
	$7,524,000

Interest on 7½ millions at 7 per cent is $525,000.

BOAT MILEAGE.

In the year 1877 there were cleared from Buffalo 6938 boats. The same number may be taken as returning, making boat clearances of 13,876. No doubt the way boats would make the total clearances considerably over 14,000 boats, or a boat mileage of

14,000 × 345 = 4,830,000 boat mileage. With the increase of traffic by the introduction of steam power, this may be assumed at 6,000,000 boat mileage.

A locomotive of power to tow five canal-boats at the rate of 2½ miles per hour will cost for current expenses, including repairs of track, about $18 per day, or 6 cents per mile, per boat. To this must be added a sum sufficient to pay interest on cost of investment. As before stated, this will be $525,000 per year. As this railway may do considerable business with the local traffic, and especially during the suspension of navigation, I estimate that at least one half of this interest will be provided for from the local traffic. There is then $262,500 that must be obtained from the profits of towing boats. I shall say more about this local traffic on another page.[1]

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[1] $262,500 divided by 6,000,000 miles = 4.38 cents per mile. This added to current expenses of locomotive (6 cents) is, say, 10½ cents per mile for towage.

In the report before referred to of the State Engineer, the estimate for this by animal power is:

For keeping and shoeing horses and renewal of horses..................	$969 90
Wages of two drivers, 24 × 7 =...	168 00
Total for the season..	$1,137 90

$1,137.90 divided by seven trips, each trip is..............................	$162 55

$162.55 divided by 690 miles (round trip), is..............	cents per mile	23 22
Add to this estimate, as before, 10 per cent................	“	2 33
Total towing by animal power............	cents per mile	25 55

Towage by animal power, per mile, is...................................	25 55
“ “ locomotive power, per mile, is................................	10 50
Saving by locomotive, per mile, is......................	15 05

Time of fleet per trip at 2½ miles per hour. To this must be added the time required to pass the locks by a fleet of five boats. At Lockport there are five combined locks. The several boats will successively follow each other in the locks, and the whole may be passed in one hundred minutes. A single lock may be passed in ten minutes, and for five boats, fifty minutes. On the section there are forty-nine

single locks..	2,450	minutes.
The Lockport combined..	100	“
Total time..	2,550	“
(when it occurs that two locks are near together, the passage may be expedited by the aid of a horse), or total time of lockage........	43	hours.
340 miles, at 2½ miles per hour, is (total from Buffalo to Aqueduct)..	136	“
Total time from Buffalo to Upper Aqueduct.......................	7.44	days.

CONDITION OF THE LOCAL TRAFFIC.

Since the enlarged boats have been put on the canal it has been found that way towns have not been able to support their independent lines, as when smaller boats were used. In consequence of this, there are but few towns that can maintain a local line of boats.

From Aqueduct to Troy there are eighteen locks on a distance of five miles that must be towed by horses. Time to pass these locks, 180 minutes.

To Troy is five miles, but as a portion of the boats go to Albany, I take this as equal to an average of eight miles. This at one mile per hour is 8 hours—together with lockage, 11 hours for this section by horses, 7.44 + .46 = 7.90 days.

For the down trips, say		7.90 days.
The return trip, ½ load, by locomotive, at four miles per hour, is 340 × 4 = days	3.10	
Lockage same as loaded, days	1.80	
	4.90	
Section Lower Aqueduct to Troy, same as time for loaded boat	46	5.36 "
Total time for round trip		13.26 "

Time by Horse-Power.

Report by State Engineer before referred to:

The down time is stated to be		10.08 days.
Return at 2 miles per hour, Troy to Buffalo		7.18 "
Total time for round trip		17.26 "
7.26 less 13.26 shows time saved		4 "
The expense of crew, and investment on boat, we have seen from State Engineer's report, is, per day		$8 42
Add, as before noticed, to this estimate 10 per cent		84
		$9 26
We have shown the cost by horse-power for towing is 25.55 cents per mile—690 miles		$176 29
By locomotives, 680 miles, by, say, 10.50 cents	71 40	
8 miles by horses at 30 cents	2 40	73 80
Saved by locomotive towing		$102 49
The 4 days' time of crew and boat saved, at $9 26 per day, is		37 04
4 days' time saved, and per round trip		139 53
I have shown from the report of State Engineer (Van Buren) the cost of a round trip between Buffalo and Troy, after adding 10 per cent to his estimate, is $384.81 + $\frac{1}{10}$ equal		423 29
I have shown there would be a saving from this by the use of locomotive steam for towage, and time of crew, and rent of boat, of		139 53
Reducing cost of round trip to		$283 76
Cost per ton carried		$1 03

This renders it difficult for them to obtain freight without unsatisfactory delay. In this town (Rome) the produce of the country was formerly sent by canal, and now almost wholly by rail. Boats from the West come usually loaded, and have no room for local freight. The delay and extra charge in obtaining boats for this purpose has thrown nearly all the East-bound freight to the rail. West-bound boats are but partially loaded, and take more or less of local freight. But unless this is offered in large lots, the boats do not like to submit to the delay it causes, and therefore their charges are near the rail rate ; and this, with the delay that often occurs, induces shippers to pay higher rates by rail, and abandon the canal. At certain points this local traffic has the competition of two railways, that enables it to obtain favorable rail freights ; but for the large portion there is no restriction, and charges are based, not on what the freights should be, under the great improvement in railway transport, but at such rates as the traffic may be made to pay.

The local district between Albany and Buffalo is rich and populous, and has a large local traffic, which it is at present important to provide for on such terms as it has a right to expect from the improved facilities of railways. The canal railway should be restricted in its charges, and by local trains provide for a want now greatly felt. In addition to this, it would be of large benefit during the suspension of navigation, giving great uniformity in charges during the entire year. From what is now claimed by railway managers, local freights should not exceed 1¼ cents per ton per mile, with the privilege of 20 cents per ton for loading and unloading freight carried less than fifty miles. This is the only measure by which the local traffic can be provided for. While the canal rail would confer a great benefit on this local traffic, it will provide income to pay one half the interest on the capital required, leaving so much less chargeable to the duty of towing boats. The result

Cost per mile	3.00	mills.
Add Mr. Stevens's estimate for repairing canal	1.50	"
Total by canal	4.50	"
Mr. Stevens puts the same cost by rail	6.50	"

It will justly be claimed the rail will have the greatest expedition, and this will influence freight more or less. On the lighter and more valuable class of freight this will be considerable, and give the rail corresponding advantage ; but the great bulk of freight requires economy, and when the time of transit is so nearly even, as it would be if steam was used in the way proposed for towing, no material advance in freight would be paid to secure it, and the cheapest method would control.

will work a double economy, as will be obvious to any one conversant with the subject. In this I make no complaint of the existing railway. The managers, as usual in such cases, do not look to the public interest, except so far as they may promote their own. But the public interest demands the canal railway as a means of sustaining the canal, which it has constructed at great cost ; and no one has the right to say the State shall not provide for and fortify its own work.

Coupling the local traffic with the canal railway is a legitimate measure, as it reduces the charge for towing the boats, and thereby cheapens canal expenses in transportation.

It has been seen that I have adopted in the preceding computations the estimate of Mr. Stevens for maintenance of canal, as 1½ mills per ton per mile. In view of the past history of canal repairs, I can not complain or question his estimate. In the opinion of intelligent men, the expenses for canal repairs have been largely in excess of what they should be. For the year 1877 a considerable reduction has been made, and the Auditor of the Canal Department has estimated the expenses of canal repairs in the future at $1,162,707. I do not know what portion he appropriates to the Erie Canal, but I infer about $900,000. This would be about one mill per mile, on the tonnage of 1877. The system of administration is now changed, and a responsible head is placed in charge of canal repairs, and it is believed the old political method will no longer prevail and affairs will be conducted on business principles, and the canal relieved from the support of dependents on political leaders. This, if realized, as we hope, will be a revival of old times in canal management, and will show the Auditor's estimate at least double what is necessary. I have not space for detail on this point, but from large experience in such work I make the above statement. If this be realized, the cost of maintenance of canal, applied to the tonnage of 1877, would be one half of one mill per ton per mile. While this result should be expected, I do not change my basis of comparison, for the reason this is not an element to determine the relative economy of towing by horse or steam.

An objection is raised to steam towing as an interference with the use of horses. The boatman employs horses because he has no other power at his command. It is not reasonable to suppose he would prefer horses, if he could be towed by steam at half the cost of horses. The railway locomotive will surely supersede horses in towing boats, and no more horses will be wanted for such purposes.

When the canal railway is once established, there will be no more demand for horses to tow boats, than to tow a train of cars on the railways.

A further objection is made, "that it will give a monopoly" to the canal railway in towing boats. It is not supposed such a company would be allowed without proper restriction, and would be placed under the control and supervision of the Canal Superintendent and Canal Board. Such a corporation would have no other connection with the boats than to tow them, and this at a fixed rate per mile, and a speed determined by the Canal Superintendent. All classes of business would easily be accommodated—through fleets, and local fleets to take up all the local boats and rafts of timber. The latter would move at times with one boat, at others with six or eight, as the local traffic should demand. The local fleets would sometimes move slower than the through fleets.

A still further objection is urged—"that though the rates are fixed, the company would obtain alterations, and in the end there would be two great monopolies instead of one." In pressing this objection it is said : "The Central was originally restricted, and not allowed to carry freight at all ; and now they have got all the restrictions removed, and are unrestrained in their charges." No doubt this is history. The Central Railroad got these restrictions removed when there was no apprehension the railroad could interfere with the canal in the great bulk of freight, and the plea was that the light freights and such as demanded expedition should be allowed to go by rail for the benefit of the public. There was hardly a dream that the railroad would absorb most of the local and become a formidable competitor for the through traffic ! And so all restrictions were taken off, in the belief it was for the public interest. Can any one believe that if the people could have anticipated the extent to which they would feel the power of the railroad, they would have consented to such power without a restriction as to rate of charges ? I think not ; and I adduce conclusive evidence of this in the matter of passenger rates. The Legislature established passenger rates, which at the time were regarded as very low ; and these were accepted by the railroad in order to secure other legislation. Now it is well known the Central Railroad has subsequently made vigorous efforts to have this restriction removed or amended, but has not succeeded. The restriction remains, and so would have remained a restriction on freight had similar circumstances existed. The question of freight has been greatly changed, and the local interest is deprived of the benefit of the improved power of railroads, that would now be secured to it if a new railway charter were asked for.

The statements of this paper show that, in the use of steam by locomotive engines in towing canal-boats, I reduce the cost of a round trip between Buffalo and Troy from $423.29 to $283.76, or a reduction of 34 per cent, or one third of cost by horses. It will be kept in view, I have adopted Mr. Stevens's estimate for canal repairs, and added to State Engineer's estimate of boating 10 per cent, and still save one third cost by steam. There is no speculation in this ; it is all based on well-known principles, and may be carried into operation on the well-established practice of engineering. The fact that it presents some novelty in the application of steam, will be of no weight to the practical mind versed in such matters. I see no other method that can give equal facility to canal transportation. It will restore to the canal its former pre-eminence in controlling the trade of the Lakes, and make this channel what it naturally is—the cheapest route between the Lakes and tide-water. This canal railway once established, the "New Zealander" will have to postpone his view of "canal ruins" until the railways improve on their economy of transportation. But it will not only improve the traffic of the Erie Canal : it will greatly advance the commercial interest of the State, both local and general. For obvious reasons, the same course should be adopted for the Oswego as for the Erie Canal.

It is material in this matter to consider that the introduction as proposed of steam-towing will be in economy more than an equivalent to the abrogation of tolls, and will relieve the canal from dependence on the public treasury. There is great doubt if the State would long support the canal by general taxes, and hence the importance of putting it in a condition to maintain itself.

WHAT OF THE FUTURE?

It may justly be claimed the railways will improve on their present economy. When they ascertain the practicability of substituting more appropriate for their heavy and clumsy rolling-stock, they will no doubt improve their economy in transportation. On the canal there are also sources of improvement. As before stated, the estimates for repairs, instead of one and a half mills, may be reduced half a mill, if not a mill, per ton per mile, as charges on transportation. A further improvement is practicable at a moderate expense, by raising the water in the canal one foot; which may be done by raising the lock-gates, or putting a plank on the top of the present gates, which would be a small expense, and raising the bank of the canal to correspond. All this may be done in the course of repairs, at no great expense, as the lock walls are now sufficient for such rise, and require no change. These means will enable the canal to improve the economy of transportation. This latter would so improve navigation that the speed of boats may be increased to three miles per hour, instead of two and a half miles.

I fully believe that intelligent and faithful administration, with improvements quite practicable, will insure not only the life, but the great usefulness of the canals to the commercial interest of the State, without any general tax for their maintenance.

If superior methods can be devised, let them have preference. My only object in this paper is to suggest what I regard entirely practicable, and, I am confident, will greatly improve the economy of transportation, and thereby promote the commercial prosperity of the State.—*International Review, May-June*, 1878.

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